

# 2004-2005 RUFFED GROUSE POPULATION STATUS IN VIRGINIA

by

GARY W. NORMAN

*Virginia Department of Game & Inland Fisheries  
P.O. Box 996  
Verona, Virginia 24482*

**Abstract:** Two spring drumming surveys and two fall hunter surveys were conducted to monitor ruffed grouse population status in Virginia. Spring 2004 breeding populations were below average based on drumming indices. Fall 2004–05 population levels were also below average based on flushing rates from grouse hunters and observations of grouse by bow hunters. Cooperating grouse hunters reported 1.03 grouse flushed per hour during the 2004–05 hunting season. Recruitment was above-average based on the percentage of juveniles harvested by grouse hunters. Grouse hunter satisfaction ratings for the 2004–05 season were improved (3.1 on scale of 1–7) compared to last year (2.7). All indices suggested a stable population at low levels in Virginia during 2004–05. Spring 2005 breeding population levels remained at low levels. Trend analyses suggest a 2.9% annual decline in grouse breeding population levels based on roadside drumming counts in Virginia over the past 10 years.

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The ruffed grouse (*Bonasa umbellus*) is a popular game bird in Virginia. Approximately 18,911 hunters hunted 94,467 days to harvest 40,070 grouse during the 2001–02 season (Drogin-Rodgers et al. 2003). Harvest management of grouse populations, by regulating hunting season length and bag limits, is the responsibility of the Virginia Department of Game and Inland Fisheries (VDGIF). The VDGIF seeks to maintain grouse populations at levels that provide quality hunting and nonconsumptive opportunities in Virginia's occupied grouse range. Annual surveys of grouse populations and harvests were used to help evaluate the status of ruffed grouse in Virginia.

The Department would like to thank the individuals who cooperated with ruffed grouse and spring grouse surveys. Appreciation is extended for their time and effort to provide valuable information for ruffed grouse management in Virginia. We would also like to thank staff of VDGIF and U.S. Forest Service for their assistance with the Roadside Drumming Survey. Special thanks are given to Mr. J. W. Coleman and H. R. Mobley for volunteering their time to assist with the Roadside Drumming Survey.

## METHODS

### Grouse Hunter Survey

A non-random volunteer group of past and new cooperating hunters (cooperators) were included in the 2004–05 survey. Past cooperators have been solicited from other VDGIF quail and woodcock survey cooperators, Virginia members of the Ruffed Grouse Society and Quail Unlimited, popular articles, and press releases.

Data sheets and wing envelopes were provided to cooperators (Appendix A). Cooperators were asked to report the number of hours they hunted, grouse flushed, and grouse killed by county and land ownership types. Cooperators were also asked to rate individual hunt quality on a scale ranging from a low of 1 (poor) to a high of 7 (excellent).

To determine sex and age related information of the grouse population, cooperators were asked to provide tail and wing feather samples from any birds they harvested. Age (juvenile or adult) was determined by examining the curvature of the tenth primary, the presence or absence of sheathing, and the length of the 9th primary (Davis 1969). Where

equivocal age determinations were found using the different techniques, curvature of the wing tip and feather sheathing were considered the most reliable techniques. Sex was determined by examining the length of plucked mid-rectrix feathers (Davis 1969). Chi-square analyses were used to compare age and sex frequency distributions by month of the season and by region (Fig. 1, 2) of the state.

Survey flushing and harvest rate information was used as indices to fall population density and trends. Information on age distribution from hunter-collected feather samples was used as an index to annual recruitment.

The grouse hunting season dates were from 25 October 2004 to 12 February 2005. The bag limit was 3 per day. The season was closed in counties east of Interstate 95.

### Fall Bow Hunter Survey

A non-random volunteer group of archery deer hunters reports the number of grouse while hunting deer in the early deer archery season. Participating archers provide information on the number of grouse seen, hours hunted, and the county hunted (Fies and Norman 2004).

### Spring Gobbler Hunter Survey

A non-random volunteer group of spring gobbler hunters, primarily National Wild Turkey Federation members, provided information during the spring gobbler season on the county hunted, number of hours hunted, number of grouse heard drumming, and the number of grouse flushed (Norman and Steffen 1992). Drumming (grouse/hunt) rates were used as indices to spring grouse population densities and trends. Drumming analyses were based on the first 2-weeks of the spring gobbler season when drumming rates were highest. Overall means and estimates were calculated as linear functions of annual estimates.

### Roadside Drumming Survey

Routes ( $n = 52$ ) were randomly chosen using 7.5 minute topographic maps within Virginia's occupied grouse range as the sampling units. Routes began at the intersection of secondary roads nearest the center of selected topographic maps. Random starting directions and random directions at subsequent

intersections were made. Routes were at least 10 miles in length with 10 listening stops at 1-mile intervals. Routes were longer if hazardous road conditions were found within 100' of the 1-mile odometer reading. Each route was surveyed twice, once during the 2<sup>nd</sup> and 3<sup>rd</sup> weeks of April. The survey began 30 minutes before sunrise. Observers recorded the number of drums during a 4-minute listening period. Disturbance was recorded (Appendix B). Stops with high disturbance were censored. Staff of the VDGIF, U.S. Forest Service, and volunteers conducted the surveys. Overall means and estimates were calculated as linear functions of annual estimates.

### Breeding Population Trend Analysis

Population trends were based on the percent change in numbers of drums heard and numbers of drumming grouse heard in the Roadside and Spring Gobbler Hunter Survey, respectively. Drumming data over 10- and 14-year periods were analyzed with a multiplicative model using a log transformation and linear regression (Sauer and Geissler 1990):

$$y = ab^xe$$

where,  $y$  = number of drums per stop or number of drumming grouse per hunt,  $x$  = year,  $a$  = intercept,  $b$  = trend, and  $e$  = error term. Logarithms were used to make the model a linear regression:  $\ln(y + 0.05) = \ln(a) + \ln(b)x + \ln(e)$ . The slope of the linear regression,  $\ln(b)$ , was back-transformed to estimate  $b$  (Bradu and Mundlak 1970) where,

$$b = e^{[\ln(b) - 0.5\text{var}\{\ln(b)\}]}$$

The percent change per year was  $100(b-1)$ . Trends were considered significant if the regression was significant ( $P < 0.05$ ).

### Brood Observation Survey

Staff of the VDGIF and Forest Service reported ancillary observations of grouse during their normal work schedule. Observations were made during the months of May through September. Personnel reported numbers of single adults, hens with broods, young grouse, and whether or not the entire brood could be counted. Brood observations were used as indices of hen success and chick survival.

## RESULTS

## Population Trends and Densities

*Spring 2004.* Roadside Drumming Survey observers heard a total of 113 drums at 981 acceptable stops. The mean number of drums heard per stop was 0.12 (Table 1). The 2004 roadside drumming rate was below the long-term survey average (0.15 drums/stop).

Cooperating spring gobbler hunters reported hearing 460 drummers and flushing 152 ruffed grouse during 1,148 hunts in Virginia's primary grouse range between 10–24 April 2004. Cooperators heard a rate of 0.40 drumming grouse/hunt and they flushed 0.13 birds/hunt during the survey period (Table 1). The 2004 drumming rate was below the survey average of 0.64 drumming grouse/hunt. In 2004 drumming declined in all regions (Table 1). Drumming rates were comparable across regions (Fig. 2).

*Fall-Winter 2004–05.* Cooperating grouse hunters ( $n=94$ ) reported data from 1,275 hunts. Cooperators averaged hunting 13.6 days during the season (Table 2). An average hunt lasted 3.3 hours (Table 2). Hunters reported flushing 4,351 birds while hunting 4,234 hours (Table 3). Flushing rates were comparably low in the early part of the season and were generally higher in December (Table 3). Throughout the season hunters averaged flushing 1.03 grouse per hour, which is lower than the long-term average of 1.16. The 2004–05 flushing rate was considerably less than the 2001–02 season where a record flushing rate (1.61) was reported. The lowest flushing rate occurred in 1976–77 (0.72 grouse/hr). Most states in the Mid-Atlantic region have also seen flushing rates decline in recent years (Fig. 5).

Cooperators harvested 453 grouse or 4.8 grouse per hunter per season. On average, 9.3 hours of hunting was required to harvest a grouse. Harvest rates were lower in October. Little difference in harvest rates (kill/hr) was found in the other months of the season (Table 3).

Cooperators in the Southern Region of Virginia's grouse range have typically reported higher flushing rates than cooperators in the Northern Region (Table 6, Fig. 1). The pattern in 2004–05 season was predictable, with flushing rates in Southern Region (1.26) exceeding the Northern (0.84). Harvest rates were also higher (0.14 kills/hr) in the Southern Region than the Northern (0.08 kills/hr). Quality

indices were 3.2 for Southern Region hunters compared to 3.0 for Northern counterparts.

Bow hunters ( $n=288$ ) reported seeing 175 grouse in 3,540 bow hunts in the 2004 archery season. In counties west of the Blue Ridge Mountains archers reported seeing 2.7 grouse per 100 hours of hunting. Archers reported seeing a high of 5.2 grouse per 100 hours in the 1997 season. The lowest number of grouse reported was in the 2003–04 season (Fig. 3).

*Spring 2005.* Roadside Drumming Survey observers heard a total of 69 drums at 812 acceptable stops. The mean number of drums heard per stop was 0.08 (Table 1). The 2005 data may suggest further decline in grouse breeding populations. The 2005 roadside drumming rate was the lowest rate observed during the 12-year history of the survey. The highest number of drums reported in the history of the 12-year survey was 189 in the 2001 survey.

Cooperating spring gobbler hunters reported hearing and flushing fewer grouse while turkey hunting in 2005 (Table 1). Both 2005 spring surveys suggest that breeding populations were below average.

*Long-Term Trends.* Trend analyses suggest that breeding population levels have declined 2.9% annually over the past 10 years using data from the roadside drumming survey ( $P < 0.001$ ). Trend data (Fig. 3) from the spring gobbler hunter survey also suggested a 2% annual decline over the past 14 years ( $P < 0.001$ ).

## Recruitment

Cooperators submitted 188 usable wings for age and sex determination. Juvenile birds comprised 52% of the sample with a ratio of 3.5 juvenile birds per adult female (Table 5). The 2004–05 recruitment index of juvenile birds in the harvest was higher than the long-term average (41%).

Juveniles normally comprise a large percentage of the harvest in the early months of the season and adults typically comprise the majority of the harvest at the end of the season. This pattern was suggested in the 2004–05 season as juveniles comprised more of the early season harvest (Table 5). However, age ratios were not significantly different by month ( $X^2 = 3.0$ ,  $df = 4$ ,  $P = 0.56$ ). No difference in age ratios were found between the Southern and Northern regions, juveniles comprised 45% of the Northern

Region and 58% of the Southern Region harvest ( $X^2 = 0.33$ ,  $df = 1$ ,  $P = 0.56$ ).

Males comprised 62% of the harvest (Table 5). Harvest sex ratios were not significantly different ( $X^2 = 7.5$ ,  $df = 4$ ,  $P = 0.11$ ) by month (Table 5) of the season or between regions ( $X^2 = 0.01$ ,  $df = 1$ ,  $P = 0.91$ ; Table 6).

The total number of grouse seen by staff ( $n = 146$ ) during the spring and summer months in 2004 was the second lowest reported in the survey history. While the number of grouse seen was low, the ratio of juveniles per brood was comparable to previous years (Table 7). Over the last 15 years the average yearly ratio has been 4.3 young/adult female.

Although males would be included as single adults, the observed ratio of successful hens to total adults observed may be a useful index to the percentage of hens that successfully hatch clutches. To be useful as a trend index, the observation probability for males and females (both successful and unsuccessful) must be consistent over time. This index indicated relatively good female success (63%) in 2004 (Table 7). Taken collectively, these recruitment results may suggest that breeding population levels were low and survival of young was low, but those broods that were successful had similar numbers of young compared to previous years.

### Hunters and Hunter Satisfactions

Cooperating grouse hunters rated hunts an average quality rating of 3.1 throughout the season based on a potential range of 1–7, where 1 was poor and 7 was excellent. The 2004–05 quality rating was much improved over last years rating of 2.7 (Table 2). Cooperators' ratings of hunting quality were slightly higher in the later months of the season (Table 3).

Cooperators hunting on private lands reported higher flushing rates (1.21) than federal (0.93) or state-owned (0.89) lands. Hunt quality ratings were higher on private lands (3.5), than on Federal (3.0) or state-owned lands (3.0).

Cooperators hunting with dogs reported higher flushing rates (1.07 flushes/hr) and harvest rates (0.11 kills/hr) than those hunting without dogs (0.61 flushes/hr, 0.08 kills/hr; Table 8). Although they flushed fewer and killed fewer birds, hunter satisfactions were higher among those hunters who did not use a dog (Table 8).

## DISCUSSION AND SUMMARY

Spring and fall population indices suggest little change in grouse populations between 2003–04 and 2004–05. Spring drummer counts suggested breeding populations were low but reproduction appeared to be above average. Therefore, the low numbers of females in the breeding population likely limited recruitment of young birds in the population. The net result was hunters reported flushing slightly more birds than last year. These results are somewhat encouraging because the population did not continue its recent decline; the bad news is that population densities were relatively low. The long-term average flushing rate is 1.16 birds per hour. The 2004–05 flushing rate was 1.03 birds per hour. Additionally, these results are supported by bow hunters that reported seeing low numbers of grouse between years in counties west of the Blue Ridge Mountains.

The cause of the recent decline in grouse numbers is unknown but the decline can be correlated with poor mast conditions, namely acorns. Acorns are a preferred food of grouse. Acorns are rich in fat and energy and during years of good acorn crops grouse body fat levels generally increase. Higher body fat levels are believed to improve grouse fitness as they move less for food, have smaller home ranges, and have reduced vulnerability to predation. Additionally, recent research has shown that reproductive success improves when female grouse have higher body fat conditions. Taken in total, acorn production is likely to be a significant factor regulating grouse populations in the Appalachians.

Grouse population indices in the Southern Region of the state typically have been higher than the Northern Region based on previous surveys. The results for 2004–05 again supported the notion that grouse populations are higher in southern Virginia. It is interesting to note however that reproduction was much higher in the Northern Region in 2004–05. Regional variation in weather and mast crops may have contributed to the apparent difference in production between areas.

Cooperating grouse hunters reported higher flushing rates on private lands than public-owned

lands. One explanation could be that private lands have better habitat or lower hunting pressure than public lands. Forest management on national forest lands is declining in Virginia so the future for grouse habitat and grouse hunting on national forest lands is uncertain.

Analyses of long-term breeding population levels suggest an annual decline of 2–3 percent in grouse numbers. Declines in habitat quality and loss of habitat could be contributing to this apparent decline in breeding population levels in Virginia. Findings of the Appalachian Cooperative Grouse Research Project (ACGRP) indicate clear cuts are critical grouse habitats and additional even-age timber management may help stabilize or increase grouse populations. Results of the ACGRP can be found on the Department's web site ([www.dgif.virginia.gov](http://www.dgif.virginia.gov)). It is apparent however that the declines seen in Virginia's grouse populations are also being seen in other states in the region (Fig. 5).

While conditions for grouse and grouse hunters have been disappointing in recent years, the prospects for 2005–06 may be improving. Although breeding population levels declined in 2005, preliminary staff reports suggest a good brood year. Hopefully this will translate to increased numbers of birds in the 2004–05 season. Grouse hunting in the Appalachians is a challenging endeavor that can be highly rewarding and enjoyable for those dedicated to the sport.

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Table 1. Mean drumming rates ( $\pm$ SE) of ruffed grouse reported by Spring Gobbler Survey hunters (drumming grouse/hunt) and the Roadside Drumming Survey (drumming grouse/route stop) in Virginia.

Year	<u>Spring Gobbler Survey</u>				<u>Roadside Survey</u>
	Southwest	Central	North	State	State
1991	0.85 $\pm$ 0.06 (451)	0.74 $\pm$ 0.06 (515)	0.92 $\pm$ 0.11 (204)	0.81 $\pm$ 0.04 (1,170)	
1992	0.90 $\pm$ 0.05 (579)	0.83 $\pm$ 0.05 (538)	1.00 $\pm$ 0.11 (169)	0.89 $\pm$ 0.04 (1,286)	
1993	0.51 $\pm$ 0.05 (433)	0.62 $\pm$ 0.05 (451)	0.37 $\pm$ 0.08 (90)	0.55 $\pm$ 0.03 (974)	
1994	0.54 $\pm$ 0.06 (343)	0.60 $\pm$ 0.04 (472)	0.71 $\pm$ 0.10 (130)	0.59 $\pm$ 0.03 (945)	0.14 $\pm$ 0.02 (882)
1995	0.62 $\pm$ 0.05 (483)	0.62 $\pm$ 0.04 (558)	1.11 $\pm$ 0.12 (159)	0.69 $\pm$ 0.03 (1,200)	0.11 $\pm$ 0.02 (932)
1996	0.60 $\pm$ 0.04 (556)	0.69 $\pm$ 0.06 (590)	0.87 $\pm$ 0.09 (182)	0.67 $\pm$ 0.03 (1,328)	0.16 $\pm$ 0.02 (897)
1997	0.65 $\pm$ 0.05 (497)	0.69 $\pm$ 0.05 (519)	0.92 $\pm$ 0.08 (263)	0.72 $\pm$ 0.03 (1,279)	0.18 $\pm$ 0.02 (951)
1998	0.61 $\pm$ 0.04 (494)	0.50 $\pm$ 0.04 (531)	0.62 $\pm$ 0.06 (245)	0.57 $\pm$ 0.03 (1,270)	0.13 $\pm$ 0.02 (929)
1999	0.58 $\pm$ 0.05 (520)	0.48 $\pm$ 0.03 (634)	0.71 $\pm$ 0.06 (289)	0.56 $\pm$ 0.03 (1,443)	0.15 $\pm$ 0.02 (884)
2000	0.63 $\pm$ 0.06 (446)	0.67 $\pm$ 0.05 (523)	0.57 $\pm$ 0.06 (272)	0.64 $\pm$ 0.03 (1,241)	0.19 $\pm$ 0.02 (697)
2001	0.71 $\pm$ 0.05 (533)	0.72 $\pm$ 0.05 (559)	0.64 $\pm$ 0.07 (279)	0.70 $\pm$ 0.03 (1,371)	0.21 $\pm$ 0.02 (885)
2002	0.62 $\pm$ 0.05 (520)	0.72 $\pm$ 0.05 (494)	0.37 $\pm$ 0.05 (279)	0.60 $\pm$ 0.03 (1,293)	0.15 $\pm$ 0.02 (913)
2003	0.52 $\pm$ 0.05 (450)	0.51 $\pm$ 0.05 (420)	0.41 $\pm$ 0.06 (264)	0.49 $\pm$ 0.03 (1,134)	0.12 $\pm$ 0.02 (896)
2004	0.45 $\pm$ 0.04 (473)	0.36 $\pm$ 0.04 (441)	0.38 $\pm$ 0.06 (234)	0.40 $\pm$ 0.03 (1,148)	0.12 $\pm$ 0.02 (981)
2005	0.53 $\pm$ 0.04 (450)	0.35 $\pm$ 0.04 (438)	0.44 $\pm$ 0.03 (226)	0.39 $\pm$ 0.02 (1,114)	0.08 $\pm$ 0.02 (812)
Average <sup>a</sup>	0.63 $\pm$ 0.01	0.63 $\pm$ 0.01	0.71 $\pm$ 0.02	0.64 $\pm$ 0.01	0.15 $\pm$ 0.01

<sup>a</sup>Overall means and estimates were calculated as linear functions of annual estimates.

Table 2. Harvest, effort, and satisfaction summary of cooperating ruffed grouse hunters in Virginia.

Year	Coop. ( <i>n</i> )	Hunts ( <i>n</i> )	Hunts/ Season	Hours/ Hunt	Grouse/ Season	Kill/ Hour	Flush/ Hour	Hunt Qty.
1990–91	110	1,241	11.3	4.1	5.5	0.12	1.03	
1991–92	93	1,204	12.9	4.0	5.2	0.10	0.98	
1992–93	81	1,106	13.7	4.0	6.1	0.11	1.01	
1993–94	61	668	11.0	3.6	3.6	0.09	1.10	
1994–95	84	1,040	12.4	3.9	5.3	0.11	0.97	
1995–96	70	780	11.1	3.7	4.8	0.12	1.50	3.2
1996–97	114	1,269	11.1	3.9	5.4	0.13	1.26	3.6
1997–98	87	1,098	12.6	3.7	5.8	0.12	1.33	3.6
1998–99	69	963	13.9	3.3	5.5	0.12	1.11	3.4
1999–00	93	1,013	10.9	3.7	4.5	0.11	1.01	2.8
2000–01	62	904	14.5	3.7	7.9	0.15	1.45	3.6
2001–02	80	1,082	13.5	3.7	8.9	0.18	1.61	4.0
2002–03	64	851	13.3	3.6	6.1	0.13	1.11	3.2
2003–04	60	779	13.0	3.5	4.5	0.10	0.92	2.7
2004–05	94	1,275	13.6	3.3	4.8	0.11	1.03	3.1

Table 3. Monthly harvest, effort, and satisfaction summary of cooperating ruffed grouse hunters in Virginia during the 2004–05 season.

Month	Days Hunted	Hours Hunted	Grouse Flushed	Flush/ Hour	Grouse Killed	Kill/ Hour	Hunt Quality
October	94	298	226	0.76	18	0.06	2.9
November	174	567	495	0.87	62	0.11	2.9
December	354	1,185	1,398	1.18	136	0.11	3.1
January	417	1,364	1,393	1.02	137	0.10	3.1
February	234	815	828	1.02	100	0.12	3.1
Season <sup>1</sup>	1,275	4,234	4,351	1.03	453	0.11	3.1

Season<sup>1</sup> = Season totals exceeds monthly totals because some hunts without dates were included.



Table 4. Sex ratios, flushing rates, and age distribution of ruffed grouse harvested by cooperating hunters in Virginia.

Season	% Males	% Females	% Juvenile	Flushes/Hour
1973-74	68	32	46	1.31
1974-75	67	33	26	1.00
1975-76	68	32	38	0.98
1976-77	64	36	20	0.72
1977-78	66	34	23	0.90
1978-79	67	33	34	1.21
1979-80	62	38	33	1.21
1980-81	65	35	36	1.44
1981-82	62	38	32	1.36
1982-83	62	38	40	1.57
1983-84	60	40	34	1.17
1984-85	59	41	43	1.17
1985-86	64	36	43	1.18
1986-87	62	38	41	1.40
1987-88	62	38	42	1.19
1988-89	67	33	22	0.83
1989-90	65	35	55	1.05
1990-91	62	38	59	1.03
1991-92 <sup>a</sup>	53 <sup>a</sup>	47 <sup>a</sup>	50	0.98
1992-93	57	43	47	1.01
1993-94	54	46	52	1.10
1994-95	63	37	32	0.97
1995-96	50	50	57	1.50
1996-97	52	48	43	1.26
1997-98	48	52	46	1.33
1998-99	56	44	46	1.11
1999-00	58	42	28	1.02
2000-01	52	48	47	1.45
2001-02	51	49	50	1.61
2002-03	57	43	38	1.11
2003-04	54	46	52	0.92
2004-05	62	38	52	1.03
Average	60	40	41	1.16

<sup>a</sup> Davis (1969) sex criteria adopted.

Table 5. Monthly age and sex composition (%) of ruffed grouse harvested by cooperating hunters during the 2004–05 season.

Month	Age		Sex		<i>n</i>
	Adult	Juvenile	Male	Female	
October	30	70	25	75	8
November	35	65	62	38	29
December	41	59	56	44	55
January	57	43	63	37	46
February	52	48	73	27	44
Season	48	52	62	38	182

Table 6. Age and sex composition of ruffed grouse harvested and flush rates by region.

Year	Percent Female		Percent Juvenile		Flushing Rate	
	North	South	North	South	North	South
1995-96	49	53	62	54	1.47	1.56
1996-97	51	45	38	46	1.17	1.37
1997-98	55	47	45	48	1.29	1.41
1998-99	42	47	44	49	1.06	1.20
1999-00	47	36	28	30	0.95	1.17
2000-01	48	48	43	52	1.36	1.64
2001-02	48	50	50	50	1.61	1.61
2002-03	49	38	33	40	0.85	1.48
2003-04	43	50	46	58	0.76	1.19
2004-05	61	39	64	36	0.84	1.26

Table 7. Grouse brood observations reported by field staff.

Year	Adults <sup>a</sup> <i>N</i>	Suc. Fem. <sup>b</sup> <i>n</i>	% Suc. Index <sup>c</sup>	Total <sup>d</sup> <i>n</i>	$\bar{x}$ Young Comp. <sup>e</sup>	$\bar{x}$ Young Incomp. <sup>f</sup>	Observers <i>n</i>
1990	94	63	67	379	4.7	4.0	23
1991	92	73	79	364	4.3	3.5	26
1992	145	91	63	406	2.8	2.6	35
1993	76	42	55	260	4.2	4.0	27
1994	149	99	66	572	4.3	4.1	30
1995	182	130	71	776	4.3	3.8	29
1996	143	59	41	367	4.0	3.5	33
1997	126	83	69	451	3.8	3.7	37
1998	114	53	46	325	4.4	3.7	28
1999	183	125	68	746	4.9	4.1	33
2000	116	47	41	225	4.7	4.9	53
2001	123	78	61	348	4.2	5.0	48
2002	78	61	78	304	4.0	3.1	33
2003	50	8	16	139	4.5	4.1	30
2004	35	22	63	146	5.0	4.1	33

<sup>a</sup> Adults = count of all adults observed<sup>b</sup> Suc. Fem. = count of females with young<sup>c</sup> % Suc. Index = (Suc. Fem./total adults)\*100<sup>d</sup> Total = total adults and young observed<sup>e</sup>  $\bar{x}$  Young Comp. = mean number of young per brood where observers reported complete counts<sup>f</sup>  $\bar{x}$  Young Incomp. = mean number of young per brood where observers reported incomplete counts.

Table 8. Dog use and the success (flush and harvest rates) and satisfaction of cooperating ruffed grouse hunters in Virginia.

Year	<u>Flushes/Hour</u>		<u>Kills/Hour</u>		<u>Hunt Quality</u>	
	Dogs	No Dogs	Dogs	No Dogs	Dogs	No Dogs
1995–96	1.58	1.38	0.12	0.07	3.6	2.5
1996–97	1.35	0.72	0.14	0.04	3.6	3.8
1997–98	1.41	0.91	0.13	0.08	3.7	4.2
1998–99	1.22	0.71	0.14	0.05	3.5	2.6
1999–00	1.09	0.59	0.11	0.06	2.8	3.4
2000–01	1.56	0.76	0.16	0.05	3.6	3.1
2001–02	1.66	1.26	0.19	0.12	4.0	4.3
2002–03	1.15	0.66	0.13	0.08	3.2	3.6
2003–04	0.98	0.48	0.10	0.04	3.0	2.8
2004–05	1.07	0.61	0.11	0.08	3.0	3.9

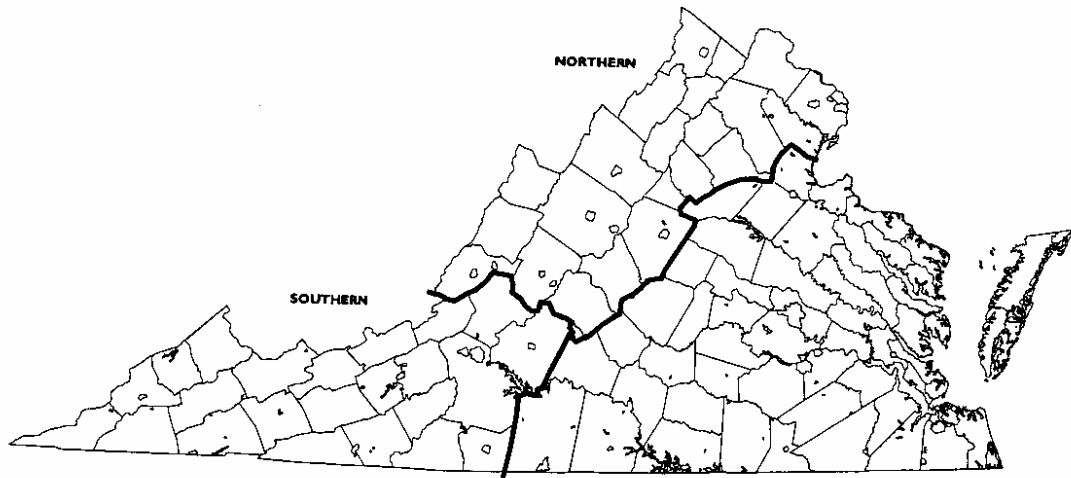


Figure 1. Ruffed grouse regions for fall hunter survey.

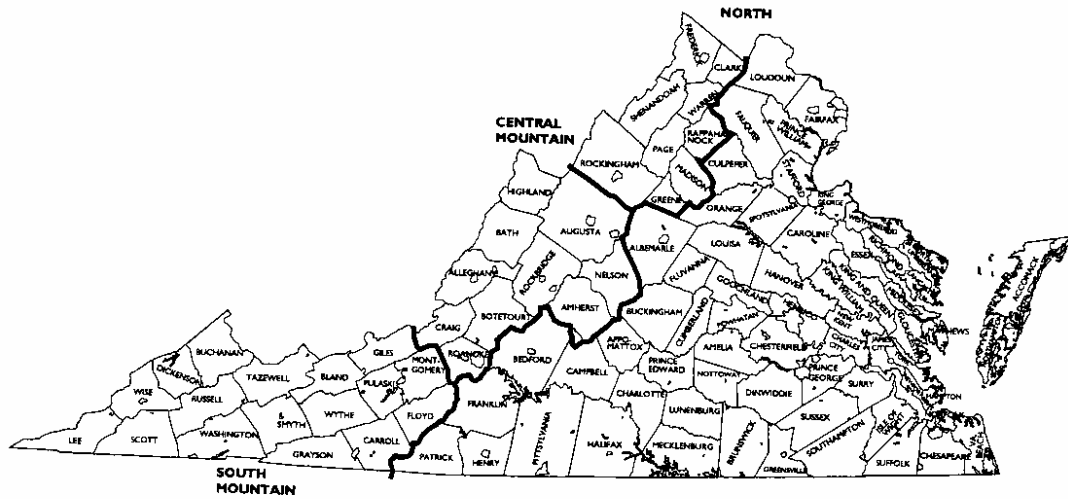


Figure 2. Ruffed grouse regions for spring drumming.

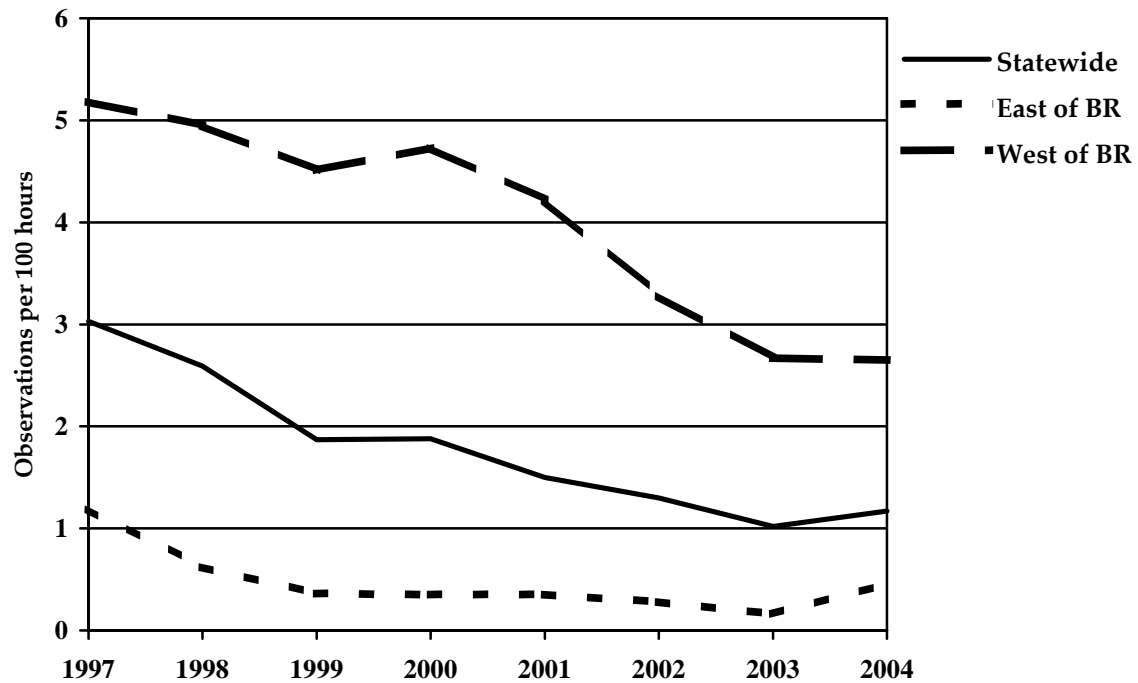


Figure 3. Ruffed grouse observed (per 100 hours of hunting) by cooperating early archery hunters from 1997–04 east and west of the Blue Ridge Mountains and statewide in Virginia.

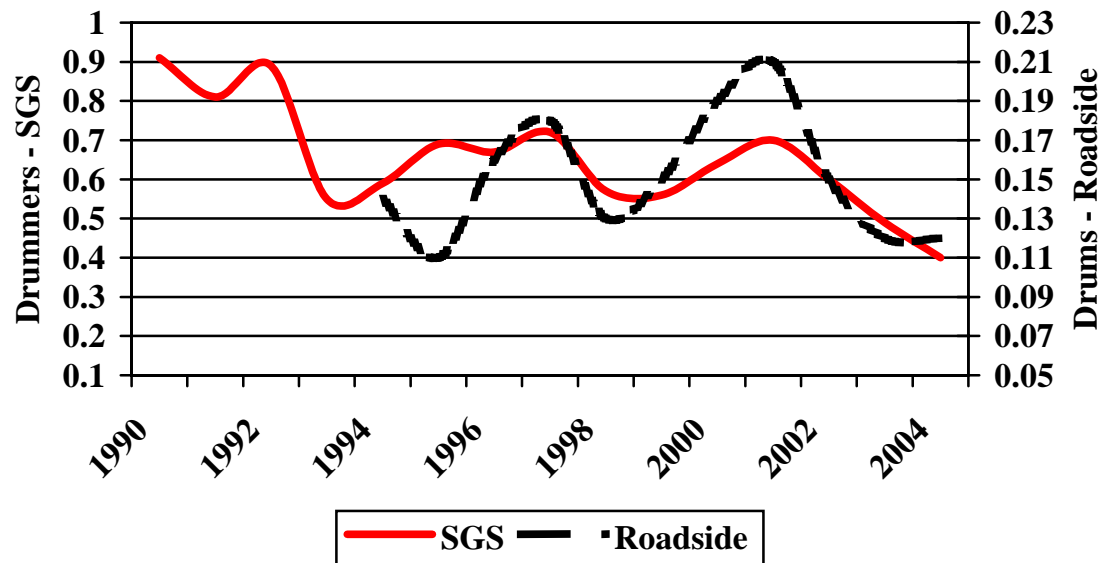


Figure. 4. Trends in breeding population indices from spring gobbler hunter surveys and roadside drumming surveys in Virginia.



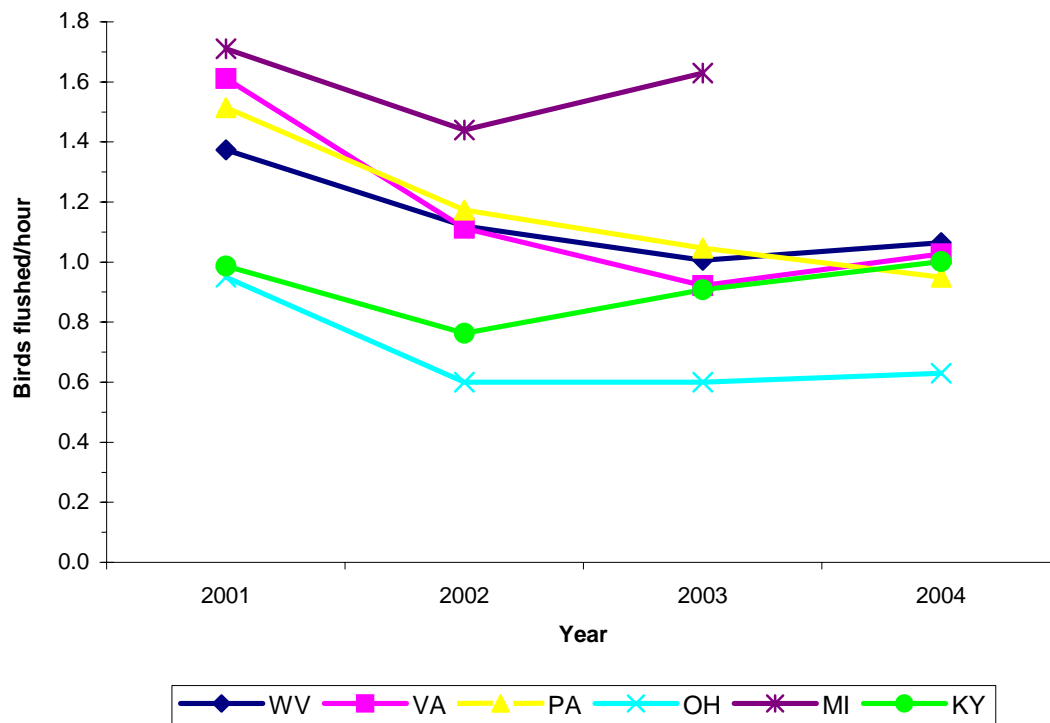


Figure. 5. Regional ruffed grouse flushing rates.

Appendix A.

RUFFED GROUSE SURVEY

NAME: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_

For further information contact Gary Norman at Virginia Department of  
Game and Inland Fisheries, P.O. Box 996, Verona, VA 24462 or call  
540-248-9389.

**INSTRUCTIONS:**  
Only one hunter per party needs to complete this  
form. Count every flush even if you believe it is the  
same bird. Count flushes whether you see the bird  
or not. All information regarding hunters and county  
information will be kept in confidence. Mail survey  
and feather samples as soon as possible after the  
season closes.

MONTH - DAY - YEAR	COUNTY	LAND TYPE	HUNTERS IN PARTY	HOURS HUNTED	GROUSE FLUSHED	GROUSE KILLED	HUNT WITH DOGS (CHECK)	DATE QUALITY OF THIS HUNT (CHECK)	COMMENTS
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## Appendix B.

<b>RUFFED GROUSE AND WILD TURKEY SURVEY</b> <b>Virginia Department of Game and Inland Fisheries</b>										ROUTE NUMBER	
OBSERVER'S NAME: (F. INITIAL, M. INITIAL, LAST) <div style="border: 1px solid black; width: 100px; height: 1.2em; margin-bottom: 5px;"></div> MAILING _____ ADDRESS _____ ZIP CODE _____ PHONE (____) _____										COUNTY	
										DATE OF SURVEY	
										YEAR      MONTH      DAY	
THIS IS THE <input type="checkbox"/> 1ST <input type="checkbox"/> 2ND RUN OF THIS ROUTE THIS YEAR  WAS THIS ROUTE RUN BY YOU LAST YEAR? <input type="checkbox"/> YES <input type="checkbox"/> NO											
OFFICIAL SUNRISE			SKY CONDITION			TEMPERATURE		WIND (See Back)		PRECIPITATION	
:      AM			<input type="checkbox"/> CLEAR <input type="checkbox"/> 1/4 OVERCAST <input type="checkbox"/> 1/2 OVERCAST <input type="checkbox"/> 3/4 OVERCAST <input type="checkbox"/> > 3/4 OVERCAST			°F      °C 35-39 <input type="checkbox"/> 2-4 40-49 <input type="checkbox"/> 5-9 50-59 <input type="checkbox"/> 10-15 60+ <input type="checkbox"/> 16+		<input type="checkbox"/> CALM <input type="checkbox"/> GENTLE (1-3 mph) <input type="checkbox"/> LIGHT (4-7 mph) <input type="checkbox"/> MODERATE (8-12 mph) <input type="checkbox"/> STRONG (> 12 mph)		<input type="checkbox"/> NONE <input type="checkbox"/> MIST <input type="checkbox"/> SNOW, HEAVY RAIN <input type="checkbox"/> FOG <input type="checkbox"/> LIGHT RAIN	
ROUTE START TIME			:      AM								
STOP NUMBER	ODOMETER READING	TIME	TOTAL DRUMS IN 4 MINUTES	NO. INDIVIDUAL TURKEYS GOBBLING	DISTURBANCE (See Back)				REMARKS		
					NO	LOW	MOD	HI			
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
TOTAL											
TOTAL STOPS		ACCEPTABLE STOPS		TOTAL DRUMS ON ACC. STOPS		NO. INDIVIDUAL TURKEYS GOBBLING		ROUTE STATUS			
DO NOT WRITE IN SHADED AREAS											
PLEASE READ INSTRUCTIONS ON REVERSE SIDE CAREFULLY AND COMPLETELY											
Main points to consider are listed below:											
(1) Conduct survey within dates specified.											
(2) Begin route 30 minutes BEFORE sunrise. Sunrise times are listed on route map.											
(3) Stops should be at 1 mile intervals. Listen for exactly 4 minutes at each stop.											
(4) Do not conduct survey if temperature is below 40° F (5° C), in moderate wind (≥ 8 mph), or if persisting rain develops.											
(5) Fill out ALL SECTIONS of this form and mail form.											

## Appendix B.

**SURVEY INSTRUCTIONS**

<b>OBSERVER</b>	It is preferable that the same observer run the same route each year. When this is not possible, it is desirable for both observers (old and new) to run the survey together once, so that there is a smooth transition with the new observer becoming thoroughly familiar with survey procedures and local route conditions. Both observers should record their results independently.
<b>DATES</b>	For 2001, the first run should be during the week of April 9-13; second run during April 16-20
<b>TIME</b>	Begin 30 minutes before sunrise. Sunrise times for April 11, 13, 15, and 17 are listed on each route map. Interpolate sunrise time for dates not listed on the map.
<b>PROCEDURE</b>	At stop No. 1 shut off your vehicle's engine, step several feet away and record the time you begin listening. Listen for 4 minutes and count total drums heard. Also determine the number of wild turkeys gobbling and record data. Then proceed rapidly 1 mile to the next stop and repeat the procedure. Continue to do so until all 10 stops have been covered. If a bad traffic hazard prevents stopping within 100 ft. of the 1 mile odometer reading, proceed to the next stop and note "no stop-hazardous" in the space for the stop omitted.
<b>THINGS TO AVOID</b>	Do not run routes when the temperature is below 40° F, in heavy precipitation or moderate wind ( $\geq 8$ mph).
<b>REPORTING</b>	Immediately after running your route for the second time, mail the forms in the envelopes provided.

<b>ESTIMATING WIND VELOCITY</b>	<b>Velocity (mph)</b>	<b>Suggestions for Estimating Wind Velocity</b>
	Less than 1	Smoke rises vertically
	1 to 3	Direction of wind shown by smoke drift, but not by wind vanes.
	4 to 7	Wind felt on face, leaves rustle, ordinary wind vane moves.
	8 to 12	Leaves and small twigs in constant motion; wind extends light flag.
	13 to 18	Raises dust and loose paper; small branches are moved.

<b>DISTURBANCE</b>	<b><u>Disturbance</u></b>	<b><u>Description</u></b>	<b><u>Example</u></b>
	NO	No appreciable effect on count.	Occasional crow calling.
	LO	Slightly affecting count.	Distant tractor noise.
	MOD	Moderately affecting count.	Intermittent traffic.
	HI	Seriously affecting count.	Heavy-continuous traffic

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